2019 年肉牛饲料添加剂国外研究进展

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摘 要: 文章搜集了 2019 年肉牛国外饲料添加剂的文章,主要从饲用微生物、矿物质、油脂、抗生素、饲用酶制剂等 5 方面进行了综述。侧重于评价各种饲料添加剂对肉牛生产性能、消化性能、瘤胃发酵和胃肠道菌群等各项指标的影响。通过了解国外肉牛饲料添加剂的研究进展,全面了解肉牛饲料添加剂的现状及其发展趋势,从而更好地指导牛业生产。

关键词: 肉牛; 饲用微生物; 矿物质; 油脂; 抗生素; 饲用酶制剂
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1 饲用微生物

饲用微生物添加剂的报道多关于犊牛的研究,通过添加酵母菌从而研究其对各性能的影响。关于对生长性能的影响结果各不相同。Villot 等[1]研究表明,酿酒酵母(CNCM I-1079)(SCB)对荷斯坦犊牛(6±3) d 的生长性能、健康水平和粪便微生物的影响,补充酵母菌(10×10^9 cfu/d)虽然未能提高平均日增重(ADG)、终重和干物质采食量(DMI)等生产性能指标,但降低了犊牛腹泻率。但 Lee 等[2]研究表明,热中性条件下添加 SCB(10×10^9 cfu/d) DMI 和饮水量显著提高,同时降低腹泻率。该试验也表明,直肠温度、心率和粪便菌群(大肠杆菌和肠杆菌)有显著降低。当热应激条件下饲料中添加 SCB 时 DMI 显著提高,但饮水量、直肠温度和血液皮质醇水平显著下降。饲用微生物不仅仅对生长性能和健康有所影响,肉牛瘤胃发酵发生相应变化。Crossland 等[3-4]也发现,日粮中添加干酵母菌有助于维持瘤胃环境的稳定。

类似研究[5]也认为,干酿酒酵母对瘤胃发酵和细菌结构产生一定影响。此外还有部分相关研究集中于酵母菌的相关产品。Saldana 等[6]通过对断奶前荷斯坦犊牛饮奶中加入酵母衍生物,虽然 ADG 无显著差异,但是肩胛骨高度和臀部宽度更大。同样 Rivera 等[7]也证实了酵母和酵母细胞壁对 ADG、终重、DMI 无显著性影响,并且证明对发病率、淘汰率和血清抗体数均无影响,对健康性能影响也有局限性。关于肉质的研究报道指出[8],添加酵母细胞壁吸附剂证明对肉的化学组成、蒸煮损失和剪切力无显著影响。

除了酵母菌饲用微生物,多种益生菌丸也可减少牛的腹泻持续时间,但对日增重并无影响[9]。Khaziahmetov 等[10]研究也认为,益生菌“Stimix Zoostim”可以降低饲料成本,提高 ADG 及蛋白质消化率,红细胞、血红蛋白和 γ-球蛋白也有所提高。Mousa 等[11]研究表明,水牛犊饲料中添加枯草芽孢杆菌可以提高 DMI、消化率、ADG 终重和饲料转化率,并且提高瘤胃中总挥发性脂肪酸(TVFA)、氨氮浓度,降低原虫的数量;血液中总蛋白(TP)、白蛋白(ALB)、甘油三酸酯、谷草转氨酶(AST)和谷丙转氨酶(ALT)水平也显著增加,尿素和肌酐水平显著降低。

2 矿物质

矿物质是机体必需的元素,矿物质无法自身产生、合成的,需要定量的从体外摄取。矿物质对牛的繁殖、免疫功能和结构发育有重要的作用,Castro 等[12]估测了荷斯坦犊牛和荷斯坦×盖尔杂交犊牛对钙(Ca)、磷(P)、钾(K)、镁(Mg)和钠(Na)的矿物质需要量,不同品种肉牛对各种矿物质需求量大部分无明显差异,并确定了空腹牛 Ca、P、K、Mg 和 Na 的净维持需要量分别为 12.73,11.81,20.28,3.50,6.37 mg/kg,其保留系数分别为 73.18%,65.20%,13.16%,29.55%,24.28%。

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Davy 等[13]对加利福尼亚肉牛的矿物质水平也进行了调查评估。不同地区和不同饲料来源的不同矿物质的水平有所差异,对于饲料中补充矿物质的群体,血液中大多数矿物质的水平有所增加且对矿质含量具有显著性影响。Vishal 等[14]研究了日粮中不同矿物质来源锌(Zn)、铜(Cu)和锰(Mn)及不同水平对印度水牛血液参数的影响。研究表明,Mn 和 Cu 的血浆水平不受有机源或无机源矿物质的影响,与无机源 100% 含量相比,有机源的血浆 SOD 含量较高,且有机源微量元素减少到 1/2 后,并未有负面影响,表明有机微量元素的生物利用度更高。同样 Van Valin 等[15]对比有机和羟基铜源相对生物利用度时也发现,饲喂高拮抗剂日粮的肉牛中,羟基铜可能更有效。对于矿物质添加剂的研究大部分集中某个特定元素对牛的影响,如 Cu、铬(Cr)、Zn 和 Mn 等常见的微量元素。Mousavi 等[16]研究了 Cr 对乳牛犊健康状况、血液特性和胰岛素敏感性的影响。证明添加 Cr 后,犊牛 DMI、ADG 有所增加还可以提高血清 TP 含量,但呼吸速率降低同时在断奶后期可减少患肺炎的天数和治疗时间,但对腹泻没有影响。Wysocka 等[17]认为 Cu 在细胞发育和代谢中起着关键作用,因为它具有很强的抗氧化活性。Feldmann 等[18]研究发现,断奶前犊牛补充蛋氨酸锌和硫酸锌均可延缓腹泻,并加快腹泻病的恢复,但对轮状病毒、细小梭状芽孢杆菌或任何单一粪便病原体,对其引起的腹泻没有治愈效果。部分研究也集中于矿物质添加剂对肉质的影响。Budde 等[19]认为,添加 90 mg Zn/kg 的日粮中添加 Cr 可提高终重、ADG、热胴体量和眼肌面积,但是 Zn 源和浓度对肝脏 Zn 和 Cu 浓度以及胴体特性没有影响。类似研究[20]也认为,不同来源及水平的 Zn 对 DMI、ADG、终重、热体重量、背膘厚、发病率或死亡率无显著影响,但是 Zn 水平升高有增加大理石花纹评分的趋势。Beyzi 等[21]关于矿物质的研究也发现,屠宰前 30 d 和 60 d 从日粮中撤除维生素和矿物质预混料对荷斯坦牛胴体和肉品质没有显著影响。此外,Khajehdizaji 等[22]在荷斯坦公犊日粮中补充不同水平脂肪酸钙盐发现,饲喂 2% 脂肪酸钙盐的犊牛 DMI 和 ADG 最高,并且饲喂脂肪酸钙盐不会显著提高蛋白质和脂肪的消化率,也不会影响血液葡萄糖、Pi 和蛋白质含量。

3　油　脂

日粮中添加精油(EO)对育肥肉牛生产性能产生一定的影响。Meschiatti 等[23]研究认为,添加 EO 的饲料提高了育肥牛的 DMI,且与外源性 α - 淀粉酶之间存在协同作用,与莫能霉素(MON)相比,添加精油显著提高了牛的生产性能和酮体重。Araujo 等[24]将微胶囊化 EO 与 MON 混合使用发现,与 EO 比较,MON + EO 的 DMI 没有显著不同;但是与 MON(9.2 kg/d vs 9.6 kg/d)或 MON + 泰乐菌素(TYL)(9.2 kg/d vs 9.6 kg/d)相比,MON + EO 的 DMI 有所降低,但增加了料重比(G∶F)。Alemu 等[25]研究了饲喂微囊化 EO、包膜硝酸盐(NO_3^-)及其组合对肉牛生长性能、摄食行为和肠道甲烷(CH_4)排放的影响。饲喂微胶囊化 EO 混合物提高了 CH_4 产量,但 DMI、ADG、G∶F 和摄食行为没有影响,且和 NO_3^- 无交互作用。Pawar 等[26]关于黄连籽油添加剂的研究发现,该油可提高 ADG 和 DMI,每头牛添加 2 mL/d 时其表观消化率较高,但不会改变 CH4 的产生。Kirisci 等[27]体外研究了红豆干草中添加大蒜油的应用效果发现,添加 0 ~ 1.2 g/L 大蒜精油可以降低 DM 和 NDF 的体外降解率,同时瘤胃氨氮物质有所下降,并有增加瘤胃 pH 的趋势。关于粗甘油的研究也有报道。Dias 等[28]研究了粗甘油代替高粱谷物的效果,认为粗甘油对 DMI、ADG 和胴体重无显著影响,粗甘油对 DMI、增重、热胴体重和屠宰率也无显著影响,但降低了 NDF 的摄入量,建议将粗甘油以 DM 总量的 15% 作为高粱谷物的替代品。此外,Quigley 等[29]研究认为,饲料中添加脂肪酸混合物可以增加 DM、有机质、淀粉、NDF、ADF、CP 和脂肪的表观消化率,且改善了肉牛的健康水平和生产性能。Inabu 等[30]研究了代乳品中添加三丁酸甘油酯的效果,认为该物质对生长参数无显著影响,且提高了血浆 GLP - 2 的浓度,尽管降低了 ME 摄入量。

4　抗生素

抗生素的研究主要集中在对奶牛瘤胃发酵、微生物菌群和健康水平方面。Li 等[31]评价了乳中抗生素对 35 日龄犊牛生长、瘤胃发酵和微生物菌群的影响。结果表明,添加抗生素对犊牛采食量、体重、肩胛骨高度、体长、胸围和 ADG 并无显著性影响,但腹泻频率有所降低,且瘤胃乙酸浓度增加,瘤胃 VFA、pH 和 NH_3 - N 并无差异。Ferreira 等[32]也研究了饲料中添加抗生素(维吉尼亚霉素和沙利霉素)对瘤胃发酵的影响,维吉尼亚霉素可提高肉牛 ADG,ADF 消化率、瘤胃 pH 和 NH_3 - N 无明显差异,但促进了 NDF 有效降解。还有部分研究针对肉牛的健康水平。Szasz 等[33]研究发现,金霉素和图拉霉素对牛呼吸道疾病的疗效,两者结合可有效降低其发病率,并改善生产性能。Oliveira 等[34]评价

了两种添加剂(MON 和 VM)在预防成年肉牛酸中毒方面的效果,预防瘤胃乳酸酸中毒最好的效果是两者结合(MON 30 ppm + VM 25 ppm),该组合可减少乳酸的生成或将 L - 乳酸转化为乙酸和丙酸,促进了瘤胃 pH 的升高,并降低 L - 乳酸的积累,减少了酸中毒。Salazar 等[35]不仅研究了添加 MON(30 mg/kg)和益生菌屎肠球菌(PROB;70 mg/kg)对肉牛生产性能的影响,还对生产性能和粪便一致性指数(FCI)进行了研究,认为断奶前各处理的 ADG 和饲料效率没有差异,MON 组 FCI 有所降低,而 PROB 组有所升高。类似研究[36]也认为,犊牛代乳粉中长期添加抗生素可以提高断奶前 DMI,并提高 DM、有机质、ADF 和 NDF 的消化率。

5 饲用酶制剂

饲料酶制剂是为了提高动物对饲料的消化、利用或改善动物体内的代谢效能而加入饲料中的酶类物质,主要研究对育肥肉牛消化率、生产性能和瘤胃发酵的影响。Meschiatti 等[23]研究发现,外源性 α - 淀粉酶与 OE 具有协同作用,与 MON 相比,可提高肉牛的生产性能和酮体重。Vigne 等[37]关于育肥牛的研究也认为,每克含酶复合物可使饲料转化率提高 0.1652%,第 1 天的粪便 DM 减少了 0.4648%,且饮水时间缩短了 0.006 8 h。Marwan 等[38]研究了外源性纤溶酶对水牛犊牛消化率和生产性能的影响。添加酶制剂的犊牛 DMI、养分消化率、ADG、终重和饲料转化率等均显着提高。同时,瘤胃 TVFA、氨气浓度和原虫数量均呈显著性增加趋势,TP、ALB 也有所增加,但对尿素、肌酐、甘油三酸酯、AST 和 ALT 水平无显著影响。Bampidis 等[39]关于枯草芽孢杆菌(DSM 28343)的研究认为,犊牛饲料中添加枯草芽孢杆菌对肠道菌群结构具有积极效果。

6 其他添加剂

关于有机盐和无机盐的研究大多集中在对胃肠道的影响上。Koch 等[40]研究认为,犊牛大量饲喂牛奶并补充丁酸盐,可使断奶犊牛的小肠粘膜生长加快,可能是由于局部胰岛素样生长因子系统参与了肠道生长调节。Alemu 等[25]研究也认为,饲料中添加微囊化硝酸盐会降低牛 DMI 和 CH_4 排放,但 ADG 和 G:F 无显著影响。关于放牧肉牛的研究也有相关报道,Granja 等[41-42]在放牧肉牛中添加硝酸盐胶囊显著影响了肠道 CH_4 排放,降低瘤胃 CH_4 还原菌的丰度。

总之,不同研究报道的数据差异性可能与牛品种、发育阶段、饲料类型和饲喂方式等因素有关,应结合实际生产进一步探讨饲料添加剂产生的经济效益。建议选择饲料添加剂时,应结合环境条件、肉牛生理阶段以及添加剂的安全性等因素,选择合适的饲料添加剂,以达到最高的添加效果。

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Correlation and Regression Analyses of the Body Weight and Body Sizes in Australian White Sheep

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Abstract: [Objective] To study the correlation and regression relationship of body weight and body size indicators in Australian white sheep and provide reference data for breeding sheep germplasm innovation application. [Method] The phenotypic correlations, path coefficients, direct and indirect correlations between the body weight and several body sizes of Australian white sheep were analyzed by SPSS 19.0 software. [Result] The cannon bone circumference (x_6) and chest circumference (x_3) showed significant correlations with the body weight at the 0.01 level. The phenotypic correlations were 0.680, 0.501. The body height (x_1) showed significant correlations with the body weight at the 0.05 level and the phenotypic correlations were 0.393. The body length (x_2), chest depth (x_4) and chest width (x_5) did not show significant correlations with the body weight at the 0.05 level. The chest circumference (x_3) and cannon bone circumference (x_6) are the main factors affecting the body weight. The body height (x_1), body length (x_2), chest circumference (x_3) and chest depth (x_4) had indirect influence by cannon bone circumference (x_6) mainly. The chest width (x_5) and cannon bone circumference (x_6) had indirect influence by chest circumference (x_3). The optimum regression equation between the body weight and body size in Australian white sheep was: $y = -39.698 + 0.355\ x_3 + 5.064\ x_6$ ($R = 0.752$, $P < 0.05$) and the normalized form of it was: $y = 0.334\ x_3 + 0.585\ x_6$ ($F = 18.815$, $P < 0.01$). [Conclusion] The optimal regression model was established between body weight and chest circumference and cannon bone circumference in Australian white sheep.

Key words: Australian white sheep; body weight; body size; correlation analysis; path analysis; stepwise analysis

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Foreign Research Progress of Beef Cattle Feed Additives in 2019

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Abstract: This paper collected the foreign feed additive articles of beef cattle in 2019, and were summered them mainly from five aspects including the feed microorganisms, minerals, oil, antibiotics and feed enzyme preparation. The effects of various feed additives on production performance, digestibility, rumen fermentation and gastrointestinal microflora of beef cattle were evaluated. Through understanding the research progress of beef cattle feed additives in foreign countries, comprehensively understand the current situation and development trend of beef cattle feed additives, so as to better guide the production of cattle industry.

Key words: beef cattle; feed microorganism; mineral substance; oil; antibiotic; enzyme preparation